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fred

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by

Fred.C. Simmons

Specialist in Logging & Primary Processing

Northeastern Forest Experiment Station
Forest Service, U.S. Dept. Agriculture

THE PURPOSES and principles of log scaling do not seem to be clearly understood, either by loggers and millmen, or by foresters. Yet scaling practices used on logging jobs and at sawmills are tremendously important to both of these groups, for two major reasons:

In the first place, scaled log volumes are the basis for many payments in the lumber industry, including payments for logs delivered to the mill or bought at roadside, and for such piece-work services as felling and bucking, skidding, and loading and hauling. Thus, the relationship of log scale to product output can profoundly affect the profit-and-loss statement of a sawmill. Involved in this relationship is not only the log-scale rule used, but also the way the logs are sawed, the degree of utilization, and--extremely important--the way the rule is applied.

In the second place, studies of milling operations and statistics on the production of the industry are usually based on reports by the operators. Many of these reports are based on scaled log volumes, others on lumber tally. The log-scale volumes are often obtained from use of local

rules, which often are applied in a non-standard manner. Lumber-tally figures will depend on the methods of sawing used and the degree of utilization obtained at the individual mill.

Conversion of these reported figures to a common basis is a difficult problem, but a very important one in accurately determining overall cut in a locality or region. It is especially important in determining growth-and-drain relationships in a region like the Northeast, where sawtimber growth is only 3 to 5 percent of the total stand volume.

It is generally known that a wide variety of log rules is used in this section of the country: at one time more than 23 different rules were used. No complete surveys have been made to show the extent to which each of these rules is used currently, and no analysis has been made of the effect of application method on the accuracy of regional production data.

In the spring of 1954, the Northeastern Forest Experiment Station conducted a survey of production at more than 800 randomly selected sawmills in the Northeast. In connection with this survey, supplemental observations of their log-scaling practices were made.

Results Of Survey

One fact brought out by this look at timber-measuring practices is that, although 23 different rules are known to have been used in the past, practically all of the scaled volume is now measured by only 7 rules. The reasons for the virtual abandonment of the other 16 are not definitely known. Undoubtedly one is that, with logs hauled longer distances to the mills, the timber-buying market has become more competitive. This has probably induced some standardization among competing log buyers. Another reason for standardization is probably that scale sticks for the more widely used rules are generally available, even at local hardware stores. Scale sticks for the less-used rules often have to be custom-made.

Another interesting fact brought out by the survey is that at more than half of the mills visited (in which about one-quarter of our northeastern lumber is produced) no log scaling is done. Most of these are smaller mills that operate their own timber or do custom-sawing for local residents and charge for their services on a mill-tally basis. Some were larger portable mills that buy timber lots on a lump-

sum basis and then log directly to the mill without doing any scaling. A few mills were purchasing logs on the basis of mill tally. These practices were most common in the southern parts of New England and the Middle Atlantic region. In Pennsylvania, Delaware, Maryland, Connecticut, Massachusetts, and Rhode Island over half the volume of logs sawed was not scaled. In New York, Vermont, New Hampshire, and Maine about 90 percent of the volume processed was scaled.

Table 1.--Scaling practices at Northeastern sawmills, 1954[1]

Rule or method used	Mills	Regional lumber volume
	Percent	Percent
Mill tally, no scaling	52	27
Doyle rule	19	20
Maine rule	6	20
Vermont or D X $\frac{1}{2}$D rule	5	10
International $\frac{1}{4}$-inch kerf rule	6	8
Cubic-foot rules	4	6
Scribner rule	5	5
Cord rules, market rules, and other miscellaneous rules	3	4
	100	100

[1]Based on observations at 800 mills.

These observations also showed that of the seven rules most commonly used, two were predominant--the Doyle rule and the Maine rule. Each was used to scale approximately one-fifth of the region's sawlog volume. The Doyle rule was the major one used among the hardwood mills in the Middle Atlantic States, and the Maine rule was the one commonly used by the softwood mills in Maine. The third most popular rule is the one known in Vermont as the Vermont or Humphrey rule, and in Delaware and Maryland as the D X $\frac{1}{2}$D rule--this being its formula; it is used to scale another 10 percent of the region's timber volume. The International $\frac{1}{4}$-inch kerf rule, the one usually advocated by foresters, is next, followed by the various cubic-foot rules and the famous old Scribner rule. Table 1 summarizes the current use

of these rules.

But the most surprising fact brought out by this survey is the way in which the region's scalers are apparently striving, consciously or unconsciously, to approximate mill tally through their methods of applying the various scale rules. Of course the values given for logs of different sizes in the rules themselves vary widely. This is because the different rules were based on different assumptions as to the utilization that could be attained from logs of different size. Many of the most popular rules were compiled a long time ago and were based on utilization standards that are now obsolete. The Maine rule, for example, assumes that no board narrower than 6 inches will be marketable. The assumptions as to utilization standards used in compiling the Doyle and Scribner rules are not so definitely known, but they obviously are not based on present standards.

Many studies have shown that values from the International $\frac{1}{4}$-inch kerf rule most closely approximate the actual yield of logs of various sizes now obtainable at reasonably efficient northeastern sawmills, when this rule is properly applied with proper reductions for rot, crook, cracks, and other product-reducing factors, and when the mill is producing 1-inch-thick lumber. When thicker material is cut, such as plank or timbers, an overrun of mill tally as compared to log scale can be expected with the International rule because producing these thicker cuttings converts into product the sawdust allowances built into the rule.

About 25 percent of the lumber cut at northeastern sawmills is thicker than 4 inches. Another factor resulting in overrun is the practice of edging to odd as well as even inch widths. On the other hand, if 1-inch lumber is cut extra thick, to compensate for variations in sawing on a worn-out or poorly adjusted mill, the International rule values cannot be attained. This is often the situation at mills sawing hardwoods, where the average board is cut 3/16 to 5/16 inch thicker than the nominal dimensions to allow for shrinkage and variations in sawing.

On the average, because of these influences, mill tally at northeastern sawmills cutting softwoods tends to overrun properly applied International rule log-scale values by 10 to 15 percent, and mill tally at sawmills cutting hardwoods tends to approach it very closely. Mill tally at individual mills will vary considerably from these averages, depending on the accuracy of setting and sawing, the amount of thick stock produced, and the degree of utilization

obtained. In areas like the mining regions, where the majority of the product at hardwood mills is heavy timbers and side cuts are made into lumber, International rule values will be exceeded substantially by mill-tally volumes.

Table 2.--Gross scale for 12-foot logs in terms of International ¼-inch rule values

Log rule	Log diameter at small end (inches)					
	8	12	16	20	24	28
	Percent	Percent	Percent	Percent	Percent	Percent
International ¼-inch	100	100	100	100	100	100
Doyle	48	70	83	86	96	103
Maine	64	107	113	110	110	106
Vermont	108	103	100	100	96	90
Scribner	80	87	92	100	97	93

A comparison of the gross scale values given by the other commonly used rules with those given by the International ¼-inch kerf rule is given in table 2.

Methods Of Application

To substantiate the statement that northeastern log scalers are attempting to approximate mill tally by their methods of applying the various log rules, the following summary of the observations made on this survey is presented.

1. Doyle rule.--The mill operators who use the Doyle Rule seem to be particularly conscious of the large overrun factor, and apparently they attempt to compensate for it in scaling (table 3). Only 4 percent of the mills using this rule were reported to be applying it to the small ends of the logs scaled, and making deductions for cull, crook, crack, and sweep. Eighty-five percent of the mills using this rule were reported to be giving gross scale, with no deductions for cull or other product-reducing factors. Many of the scalers believe that this is the way the rule was in-

tended to be applied. At the mills reported to be making some deductions, the common method was to give culled logs the volume that they would "saw out" in the judgment of the scaler, rather than making a deduction from the tabulated rule values.

Another common practice among scalers who use the Doyle Rule is to include one or both bark thicknesses in the scaled volume of the log or to build up very small log footage by crediting the log with a number of board feet equal to the log length in feet. At some mills, no acceptable log is given a scale of less than 20 board feet. Some millmen measure very small logs at the large end rather than the small end; and in New Jersey and adjacent areas the rule is commonly applied to the middle diameter of the log. Many millmen in all sections of the Middle Atlantic Region said that, with the type of logs they now receive, they can no longer "saw out" the volumes obtained by use of the Doyle rule, as locally applied.

Evidence that this belief is justified in some cases was obtained at a mill in northern New York State, where a careful record was made of the lumber tally from 1,000 hardwood logs averaging about 14 inches in diameter. Twenty-five percent of the mill's production was thick stock. The

Table 3.--Scaling practices of mills that use Doyle log rule[1]

Scaling practice	Mills	Volume
	Percent	Percent
Mills scaling gross (no deductions):		
Small end, inside bark	55	46
Small end, including one bark	17	17
Small end, including both barks	7	5
Middle diameter	6	4
	85	72
Mills scaling net (some deductions):		
Small end, inside bark	4	13
Small end, including one bark	8	7
Small end, including both barks	1	1
Middle diameter	2	7
	15	28

[1]Based on observations at 152 mills.

total lumber tally from these logs was 3.5 percent less than the volumes scaled for these logs by the Doyle rule, applied following common local practice. Scaling was gross, with no deductions of any kind, and was based on the diameter at the small end of the logs, including one bark thickness. The logs, as is typical in the locality, were rather crooked and contained considerable frost crack and rot. If scaled properly, they would have been subject to about 15 percent deduction for these factors.

2. Vermont and International rules.--One third of the mills in New England that use the Vermont and International rules were reported to be making no deductions whatever. Those that do make deductions were reported generally to be crediting culled logs with the volume the scaler thought they would "saw out." This method generally results in inadequate deductions because no allowance is made for the kerf or the normal included sweep allowance that is built into the rules. Very few scalers using these rules seem to have a good working knowledge of the latest and best techniques of scaling.

3. Maine rule.--The Maine rule is used primarily by mills cutting softwoods in the State of Maine. Approximately 90 percent of the volume sawed in that State is scaled, and the volumes are reported in terms of this rule. The rule is applied generally on a net basis; only a little over 1 percent of the mills report gross scaling.

All of the mills observed using this rule scaled at the small end of the log inside the bark. The majority, however, were reported to be making small deductions for sweep and crook in small logs. Consequently the conservatism of the rule in the 8- and 10-inch diameters is generally compensated for. From 12 inches up, the Maine rule values are somewhat in excess of those given by the International rule. It is reported that the Maine rule values, thus scaled, closely approximate actual lumber volumes produced by the methods of sawing practiced in that state. Because of the percentage of thick stock included, these values would exceed by 10 to 15 percent the volume of 1-inch-thick stock that could be obtained from these logs.

4. Scribner rule.--More than half of the mills that use the Scribner rule were reported to be applying it gross, with no deductions; and some 30 percent of these mills were including one bark thickness in their scaling diameters. With this rule too, the mills making some deductions for cull and other product-reducing factors were reported generally to be making very inadequate ones, generally crediting the culled logs with the volume it was thought they would yield.

Summary

From these observations at more than 800 sawmills in the Northeast, the following conclusions can be drawn:

1. A large volume of the region's sawlogs, about one-fourth of the total sawed, is not scaled at all. This is usually the practice at small farmer-operated and custom mills, and at some of the larger portable mills in the commercial class. Production records, therefore, are based on actual lumber tally.

2. Approximately three-quarters of the total volume of logs sawed is scaled by one of seven rules; and the major portion of this volume is measured by the Doyle, Maine, and Vermont Rules.

3. On the surface it would appear that the regional lumber-production figures obtained from these systems of measurement would be significantly inaccurate, and would be on the low or conservative side. This does not appear to be true, however, for our analysis shows that:

> Application of the several rules, due to competition for timber and lack of understanding of procedures for making deductions, tends to reduce theoretical overruns. Most scalers seem to be attempting to approximate mill tally in their scaled total volumes, and they succeed fairly well in that attempt regardless of log rule used.
>
> Overruns from application of a scaling method to one lot of logs, and underruns from another, tend to compensate. This results in some serious injustices between different log suppliers. A man who delivers sound straight logs to a mill that buys logs on a gross-scale basis is discriminated against as compared to a man who delivers crooked and partially rotten logs.

4. Consequently, increasing the scaled volumes reported by the mills that use the more conservative log rules, by a percentage for overrun derived by comparison of the gross rule values, is generally unjustified. To bring these reported totals into agreement with cruise data, derived from application of net International rule values, will more generally require a reduction for underrun rather than an increase for overrun. This is because mill-tally volumes, with the percentage of stock thicker than 1 inch currently sawed in the northeast, will often exceed theoretical International rule values by 10 to 15 percent.

5. There is a great need--and a considerable desire --for instruction in more accurate methods of scaling among northeastern sawmill operators. This is because of the injustices that result from present methods of scaling among different log suppliers, but more particularly because present methods of scaling often give excessive volumes for the type of logs that many mills now receive. For example, the assumption that the overrun built into the Doyle rule values will compensate for cull and other product-reducing factors in the logs is often no longer true because of lower quality of logs now accepted at many mills. It is believed that the forestry agencies in the region should be more active in supplying to the millmen instructions in more accurate methods of scaling.

Agriculture-Forest Service-Upper Darby